REMARKS

Claims 1-11, 13-55 and 62 are pending. By this Amendment, claims 56-61 are canceled without prejudice or disclaimer and claims 1, 6, 24, 25, 50, 51 and 62 are amended. Reconsideration in view of the above amendments and following remarks is respectfully requested.

Claims 6, 7, 12, 34 and 39 were rejected under 35 U.S.C. § 112, 2nd paragraph.

Claim 6 has been amended to obviate the rejection.

With respect to claims 7 and 34, it is respectfully submitted that those of ordinary skill in the art of photolithography understand the term "evacuated" to mean that the beam path is a vacuum, or a near vacuum (i.e. as near a vacuum as may be provided).

With respect to claims 12 and 39, it is respectfully noted that Applicants are not claiming purge gas. Applicants are also not claiming inert gas, as alleged by the Examiner. Applicants are claiming an absorbent gas serving to absorb energy delivered by the beam of radiation.

Reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, 2nd paragraph are respectfully requested.

Claims 1-7, 9-34, 36-44 and 47-62 were rejected under 35 U.S.C. §102(e) over Nishi (U.S. Patent 6,545,746) and claims 8, 35, 45 and 46 were rejected under 35 U.S.C. § 103(a) over Nishi in view of Tanaka (U.S. Patent Application Publication 2003/0020888 A1). The rejections are respectfully traversed.

Claims 1, 24, 25, 50, 51 and 62 have been amended to recite the absorbent gas comprises one of xenon (Xe); water (H_2O); hydrocarbons; and compounds and mixtures thereof. Nishi does not disclose or suggest this feature.

Nishi disclose in column 36, line 2, that ozone (O_3) may be used to absorb the illuminating light. Nishi also disclose in column 36, lines 44-46, that oxygen (O_2) may be used in place of ozone.

With respect to the Examiner's continued insistence that Nishi discloses helium and nitrogen as absorbent gases (page 3, line 6, of the Office Action), as discussed in previous replies, Nishi discloses in column 55, lines 1-2, that helium does not absorb exposure light. Nishi further discloses in column 34, lines 28-32, that the absorption of ArF excimer laser light by nitrogen gas is so small as to be substantially negligible.

Claims 2-11and 13-23 recite additional features of the invention and are allowable for the same reasons discussed above with respect to claim 1 and for the additional features

recited therein. In addition, Tanaka et al. fail to cure the deficiencies of Nishi with respect to claim 1 and even assuming it would have been obvious to combine the references, which Applicants do not concede, such a combination would not have resulted in the claimed invention.

With respect to claim 26, the Examiner alleges that Nishi inherently discloses a radiation-energy detector to determine energy of radiation passing through a region of interactive gas (page 4, line 12, of the Office Aciton). However, the Examiner provides no basis in fact and/or technical reasoning for this conclusion, as required by MPEP § 2112, other than to allege that somewhere in the 28 columns between column 35 and column 63 that Nishi discloses a radiation energy detector to determine energy of radiation passing through a region of interactive gas. It is respectfully submitted that Nishi do not inherently disclose a radiation-energy detector configured to determine the energy of the beam of radiation, the beam of radiation passing at least partly through a region of interactive gas, the detector comprising a sensor, the sensor, in operation, providing an output signal that is proportional to an amount of interaction of the beam of radiation with the region of gas, as recited in claim 26.

Nishi disclose in column 36, lines 1-24, that the pressure of the gas in container 141 is controlled, and the absorptance of the gas is dependent on the pressure of the gas in the container (i.e. if the pressure in container 141 is reduced to close to a vacuum the absorptance increases, and when it is desired to reduce the amount of illuminating light IL, the pressure of the gas in the container 141 is increased). It is respectfully submitted that it is more likely that Nishi's container 141 includes a pressure sensor than it necessarily includes a radiation energy detector.

Claim 52 recites, *inter alia*, a radiation-energy sensor proximate to the volume, the sensor, in operation, providing an output signal that is proportional to an amount of interaction of the projection beam with the absorbent gas. Nishi does not disclose this feature, either explicitly, implicitly, or inherently.

Claim 54 recites, *inter alia*, determining the energy of the radiation by measuring an amount of interaction of the radiation with the absorbent gas, wherein results of the measurement are used to control the at least one of the energy and the duration. There is no disclosure or suggestion of this feature by Nishi.

Claim 55 recites, *inter alia*, determining the energy profile of the radiation by measuring an amount of interaction of the radiation with the absorbent gas at a plurality of

points, wherein results of the measurement are used to control the energy profile control of the patterned beam. Nishi neither discloses nor suggests this feature.

Claims 27-49 and 53 recite additional features of the invention and are allowable for the same reasons discussed above with respect to claims 26 and 52 and for the additional features recited therein. In addition, Tanaka et al. fail to cure the deficiencies of Nishi with respect to claim 26 and 52 and even assuming it would have been obvious to combine the references, which Applicants do not concede, such a combination would not have resulted in the claimed invention.

Reconsideration and withdrawal of the rejections over Nishi and Nishi in view of Tanaka et al. are respectfully requested.

Claims 1-7, 12-34, 36-44 and 47-62 were rejected under 35 U.S.C. 102(e) over Shiraishi (Japanese Patent Application Publication 2003-257822). The rejection is respectfully traversed.

It is respectfully noted that the only prior art that may be applied under 35 U.S.C. § 102(e) is 1) U.S. patents; 2) U.S. patent application publications; and 3) International (PCT) applications published in English under Article 21(2) that designated the United States. Shiraishi is none of these.

However, as Shiraishi may qualify as prior art under 35 U.S.C. § 102(a), the undersigned provides the following remarks. Prior to those remarks, it is respectfully noted that MPEP § 706.02 II states:

> Prior art uncovered in searching the claimed subject matter of a patent application often includes English language abstracts of underlying documents, such as technical literature or foreign patent documents which may not be in the English language. When an abstract is used to support a rejection, the evidence relied upon is the facts contained in the abstract, not additional facts that may be contained in the underlying full text document. Citation of and reliance upon an abstract without citation of and reliance upon the underlying scientific document is generally inappropriate where both the abstract and the underlying document are prior art. See *Ex parte Jones,* 62 USPQ2d 1206, 1208 (Bd. Pat. App. & Inter. 2001) (unpublished).To determine whether both the abstract and the underlying document are prior art, a copy of the underlying document must be obtained and analyzed. If the document is in a language other than English and the examiner seeks to rely on that document, a translation must be obtained so that the record is clear as to the precise facts the examiner is relying upon in support of the rejection. The record must also be clear as to whether the examiner is relying upon the abstract or the full text document to

> support a rejection. The rationale for this is several-fold. It is not uncommon for a full text document to reveal that the document fully anticipates an invention that the abstract renders obvious at best. The converse may also be true, that the full text document will include teachings away from the invention that will preclude an obviousness rejection under 35 U.S.C. 103, when the abstract alone appears to support the rejection. An abstract can have a different effective publication date than the full text document. Because all patentability determinations are fact dependent, obtaining and considering full text documents at the earliest practicable time in the examination process will yield the fullest available set of facts upon which to determine patentability, thereby improving quality and reducing pendency. When <u>both</u> the abstract and the underlying document qualify as prior art, the underlying document should normally be used to support a rejection. In limited circumstances, it may be appropriate for the examiner to make a rejection in a non-final Office action based in whole or in part on the abstract only without relying on the full text document. In such circumstances, the full text document and a translation (if not in English) may be supplied in the next Office action. Whether the next Office action may be made final is governed by MPEP § 706.07(a). (Underlining emphasis in original.)

It is respectfully noted that no translation of Shiraishi was provided with the Office Action. A machine translation of Shiraishi, obtained from the Japanese Patent Office website, is attached to this response.

With respect to independent claims 1, 24, 25, 50, 51 and 62, Shiraishi neither discloses nor suggests the claim absorbent gas(es).

With respect to independent claims 26, 52, 54 and 55, the claimed radiation energy detector/sensor of claims 26 and 52 are fully supported by grand-parent application 09/866,875, filed May 30, 2001, now U.S. Patent 6,538,716, which relied for priority on European Applications 00304673.7, filed June 1, 2000, and 00304760.2, filed June 6, 2000, certified copies of which, in English, were submitted in the grand-parent application. See, for example, the energy sensor ES of U.S. Patent 6,538,716.

In addition, determining the energy of the radiation by measuring an amount of interaction of the radiation with the absorbent gas, wherein results of the measurement are used to control the at least one of the energy and the duration, as recited in claim 54, and determining the energy profile of the radiation by measuring an amount of interaction of the radiation with the absorbent gas at a plurality of points, wherein results of the measurement are used to control the energy profile control of the patterned beam, as recited in claim 55 are

fully supported by the grand-parent application. See, for example, the discussion of Figure 3 and the control circuit in U.S. Patent 6,538,716.

Shiraishi is thus not prior art against, at least, independent claims 26, 52, 54 and 55. Applicants reserve the right to submit evidence of invention earlier than Shiraishi's September 12, 2003 publication date for all claimed subject matter.

Reconsideration and withdrawal of the rejection over Shiraishi are respectfully requested.

Claims 56-61 were rejected under 35 U.S.C. § 102(e), or in the alternative under 35 U.S.C. § 103(a), over Akagawa et al. (U.S. Patent 6,288,769).

Claims 56-61 have been canceled without prejudice or disclaimer, thus rendering moot the rejection.

Claims 1-7, 9, 12, 13, 15-19, 21-26, 29, 31-34, 39-43 and 47-62 62 were rejected under the judicially created doctrine of obviousness-type double patenting over claims 1-23 of U.S. Patent 6,538,716 and claims 8, 14, 30 and 35 were rejected under claims 1-23 of the '716 patent in view of Tanaka et al. The rejections are respectfully traversed.

The undersigned traversed the double patenting rejection in the: 1) August 4, 2005 Amendment Under 37 C.F.R. § 1.111; 2) December 12, 2005 Amendment After Final Rejection Under 37 C.F.R. § 1.116; and 3) January 17, 2006 Pre-Appeal Brief Request for Review. Despite these three traversals, all of which specifically pointed out the errors in the rejection, the Examiner has never responded to the substance of the undersigned's arguments, as required by MPEP § 707.07(f), and merely repeated the rejections essentially verbatim. Rather than burden the instant reply with another discussion of the numerous failings of the rejections to present a *prima facie* case of obviousness-type double patenting, the undersigned incorporates the arguments contained in the three responses discussed above into the instant response. Should the Examiner insist on maintaining the rejections, the Examiner is respectfully requested to perform the required analysis and address the substance of the undersigned's arguments.

Although the undersigned appreciates the Examiner's discussion of the difference between petitionable and appealable subject matter, as discussed above, as the Examiner continues to ignore the undersigned's arguments it is respectfully submitted that no recourse exists. How many notice of appeal and petition fees must be paid to obtain a response that addresses the substance of the arguments presented? It is respectfully submitted that the fees paid thus far are more than sufficient.

In view of the above amendments and remarks, Applicants respectfully submit that all the claims are allowable and that the entire application is in condition for allowance.

Should the Examiner believe that anything further is desirable to place the application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,
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Attachment: Translation of JP 2003-257822 (Shiraishi)

PATENT ABSTRACTS OF JAPAN

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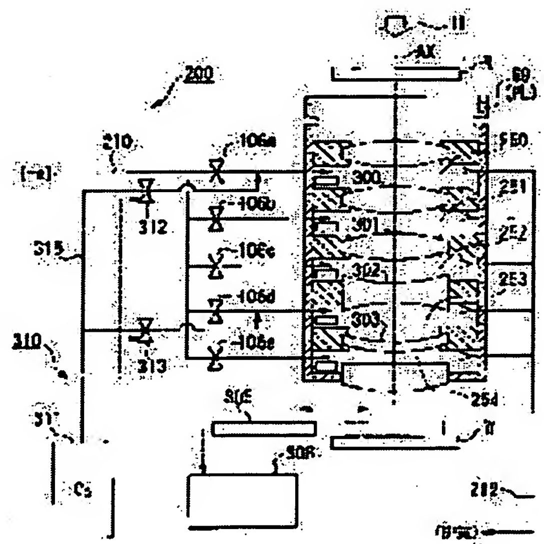
(71)Applicant : NIKON CORP
(72)Inventor : SHIRAISHI NAOMASA

(54) OPTICAL DEVICE AND ALIGNER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an optical device which is capable of keeping an energy beam uniform in intensity distribution.
SOLUTION: The optical device PL is provided with a plurality of empty spaces 250 to 254 formed on an optical path of the energy beam IL. The empty spaces 250 to 254 are set different from each other in shape in the traveling direction of the energy beam IL. The optical device PL is equipped with a concentration control device 200 which controls concentration of a light absorbing material that fills the empty spaces 250 to 254 to absorb the energy beam IL, corresponding to the shape of the empty spaces 250 to 254.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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[Date of extinction of right]

* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] It is optical equipment characterized by to have the concentration control unit which controls separately the concentration of the extinction matter which consists of a configuration from which two or more of said space differs mutually about the progress approach of said energy beam in the optical equipment which has two or more space formed on the optical path of a energy beam , and absorbs said energy beam in each of two or more of said space according to the configuration of each space .
[Claim 2] Said two or more space is optical equipment according to claim 1 characterized by having the space of both the convex configuration, and the space of both the concave configuration about the travelling direction of said energy beam.
[Claim 3] Said concentration control device is optical equipment according to claim 1 or 2 characterized by having the metering device which measures the optical information on said energy beam which passed through said two or more space, and the gas transfer unit which supplies the gas containing said extinction matter to at least one space in said two or more space based on the measurement result of this metering device.
[Claim 4] The aligner characterized by at least one side of the illumination-light study system which illuminates the mask with which the pattern was formed by the energy beam, and the projection optical system which imprints the pattern of said mask on a substrate equipping any 1 term of claim 1 to the claims 3 with the optical equipment of a publication.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical equipment which has two or more space formed on the optical path of a energy beam, and relates to the optical equipment used for the aligner for manufacturing electron devices, such as a semiconductor device, a liquid crystal display component, image sensors (CCD etc.), and the thin film magnetic head, especially.
[0002]
[Description of the Prior Art] In case devices (electron device), such as a semiconductor device and liquid crystal display panels (integrated circuit etc.), are manufactured in a photolithography process, a mask or reticle (it is hereafter named reticle generically) is illuminated by the illumination light for exposure from the light source (exposure beam), and the aligner which imprints the pattern (circuit pattern) of reticle through a projection optical system to substrates (a wafer, a glass plate, etc. with which the sensitization agent was applied) is used. The circuit of an electron device is imprinted by exposing a circuit pattern on the above-mentioned substrate with the above-mentioned projection aligner, and is formed of after treatment. In this way, that which stratified circuit wiring formed repeatedly over about 20 layers is an integrated circuit.
[0003] In recent years, high density integration of an integrated circuit, i.e., detailed-izing of a circuit pattern, is advanced, and it is in the inclination for the exposure beam in an aligner to be short-wavelength-ized, in connection with this. That is, as an exposure beam, as for the bright-line glue of a mercury lamp which was in use until now, KrF excimer laser (wavelength: 248nm) comes to be used, and utilization of the ArF excimer laser (193nm) of short wavelength is also going into a culmination further. Moreover, aiming at the further high density integration, research of F2 laser (157nm) or Ar2 laser (126nm) is also advanced.
[0004] Light (energy beam) with a wavelength of 120nm - about 200nm belongs to a vacuum ultraviolet area, and such light (vacuum-ultraviolet light is called hereafter) does not penetrate air. This is because luminous energy is absorbed with molecules (it is hereafter called the "extinction matter"), such as oxygen contained in air, water, carbon dioxide gas, the organic substance, and a halogenide.
[0005]
[Problem(s) to be Solved by the Invention] Therefore, in the optical equipment which constitutes the aligner using vacuum-ultraviolet light, in order to make an exposure beam reach a substrate with sufficient illuminance homogeneity which is sufficient illuminance, it is necessary to eliminate the gas which contains extinction matter, such as oxygen, from between an exposure beam optical-path being absentminded as much as possible. As an approach of eliminating the extinction matter, the approach of filling between optical-path absentminded with gas with little vacuum-ultraviolet luminous energy absorption (low absorptivity gas) is learned.
[0006] However, since it is difficult to eliminate the extinction matter thoroughly from between optical-path absentminded, a part of energy of an exposure beam will be absorbed by passing through between optical-path absentminded. Moreover, a part of energy of an exposure beam is absorbed by the optical

member arranged on an optical path. On an optical path, with the optical equipment which has two or more space and two or more optical members, absorption of such energy serves as nonuniformity of the intensity distribution of an exposure beam, and tends to appear.

[0007] This invention is made in view of the situation mentioned above, and aims at attaining equalization of the intensity distribution of a energy beam in the optical equipment which has two or more space formed on an optical path. Moreover, other objects of this invention are to offer the aligner which can raise exposure precision.

[0008]

[Means for Solving the Problem] In the optical equipment (PL) which has two or more space (250-254) where the optical equipment of this invention was formed on the optical path of a energy beam (IL) said two or more space (250-254) It consists of a mutually different configuration about the travelling direction of said energy beam (IL). It is characterized by having the concentration control unit (200) which controls separately the concentration of the extinction matter which absorbs said energy beam (IL) in each of two or more of said space (250-254) according to the configuration of each space (250-254). it becomes possible to control the intensity distribution of the energy beam in a injection edge by controlling separately the concentration of the extinction matter of two or more space on an optical path which boils, respectively and can be set by this optical equipment according to the configuration of that space. That is, when the extinction matter is contained between optical-path absentminded, in the energy beam which passed through the space, the nonuniformity on the strength according to the configuration of the space arises. Therefore, such nonuniformity on the strength becomes possible [making the intensity distribution of the energy beam injected into homogeneity] according to the configuration of each space by controlling the concentration of the extinction matter in each of two or more space separately so that may be canceled.

[0009] For example, since the optical path of a periphery is short compared with near an optical axis (AX), when the extinction matter is contained in the space (253) of both the convex configuration about the travelling direction of said energy beam (IL) in the space (253), more energy beams (IL) passing through near an optical axis (AX) are absorbed. On the contrary, since the optical path of a periphery is long compared with near an optical axis (AX), when the extinction matter is contained in the space (251) of both the concave configuration about the travelling direction of said energy beam (IL) in the space (251), more energy beams which pass along a periphery compared with near an optical axis (AX) are absorbed. Therefore, it sets to the optical equipment (PL) which has the space (253) of both [these] the convex configuration, and the space (251) of both the concave configuration. If concentration of the extinction matter in the space (253) of both the convex configuration is made high and near an optical axis (AX) will make high concentration of the extinction matter [in / it becomes low and / to reverse / the space (251) of both the concave configuration] compared with a periphery, the reinforcement of a energy beam (IL) Compared with near an optical axis (AX), as for the reinforcement of a energy beam (IL), a periphery becomes low. Thus, it becomes possible by controlling the concentration of the extinction matter of each space of both the convex configuration and both the concave configuration to control to homogeneity the nonuniformity of the near the optical axis of a energy beam and the periphery which passed through two or more space on the strength.

[0010] As for said concentration control device (200), in the above-mentioned optical equipment (PL), it is desirable to have the metering device (305) which measures the optical information on said energy beam (IL) which passed through said two or more space (250-254), and the gas transfer unit (310) which supplies the gas containing said extinction matter to at least one space in said two or more space (250-254) based on the measurement result of this metering device. It becomes possible by supplying the gas containing the extinction matter between optical-path absentminded to control the concentration of the extinction matter of the space. Moreover , equalization of the reinforcement of the energy beam in the injection edge of optical equipment can be attain by supply the gas containing the extinction matter to at least one space in two or more of the space , and control the concentration of the extinction matter of the space so that the optical information on the energy beam which passed through two or more space on an optical path may be measure and the nonuniformity of a energy beam on the strength may be cancel

based on the measurement result .
[0011] It is characterized by equipping with the above-mentioned optical equipment at least one side of the illumination-light study system (21) in which the aligner (10) of this invention illuminates the mask (R) with which the pattern was formed by the energy beam (IL), and the projection optical system (PL) which imprints the pattern of said mask (R) on a substrate (W). In this aligner, since the homogeneity of the energy beam irradiated by the substrate on the strength improves, exposure precision improves.
[0012]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained. Drawing 1 shows the whole cutback projection mold aligner 10 configuration for semiconductor device manufacture concerning 1 operation gestalt equipped with the optical equipment concerning this invention as a projection optical system. Moreover, the XYZ rectangular coordinate system is adopted in drawing 1 . The X-axis and a Y-axis are set up so that it may become parallel to the wafer stage WS holding the wafer W as a substrate (photosensitive substrate), and a XYZ rectangular coordinate system is set up in the direction in which the Z-axis intersects perpendicularly to the wafer stage WS. Actually, the XYZ rectangular coordinate system in drawing is set as the field where XY flat surface is parallel to the level surface, and the Z-axis is set up in the direction of a vertical.
[0013] F2 laser light source is being used for the aligner concerning this operation gestalt as the exposure light source. Moreover, step - and - scanning method which imprint the pattern image of Reticle R on a target serially are adopted as one shot field on Wafer W by synchronizing and scanning Reticle R and Wafer W in the predetermined direction relatively to the lighting field of the predetermined configuration on the reticle R as a mask (projection original edition). In the aligner of such step - and - scan mold, the pattern of Reticle R can be exposed to the field on a substrate (wafer W) larger than the exposure field of a projection optical system.
[0014] The aligner 10 is equipped with the main control unit which is not illustrated [which controls in generalization a laser light source 20, the illumination-light study system 21 which illuminates Reticle R by the exposure beam IL as a energy beam from this laser light source 20, the projection optical system PL which projects the exposure beam IL injected from Reticle R on Wafer W, and the whole equipment] in drawing 1 . Furthermore, the aligner 10 is contained inside the large chamber (un-illustrating) as a whole.
[0015] A laser light source 20 has F2 laser which outputs pulse ultraviolet radiation with an oscillation wavelength of 157nm. Moreover, the light source control unit which is not illustrated is put side by side to the laser light source 20, and this light source control unit performs control of the oscillation core wavelength of the pulse ultraviolet radiation injected, and spectral half-width, trigger control of a pulse oscillation, control of the gas in a laser chamber, etc. according to the directions from a main control unit.
[0016] The pulse laser light (illumination light) from a laser light source 20 is deflected by the deflection mirror 30, and carries out incidence to the adjustable beam attenuator 31 as an optical attenuator. The adjustable beam attenuator 31 can be adjusted gradually [the rate of dimming], or continuously, in order to control the light exposure to the photoresist on a wafer. The illumination light injected from the adjustable beam attenuator 31 reaches the 2nd fly eye lens 36 through the 1st fly eye lens 33, a zoom lens 34, and oscillating mirror 35 grade in order, after being deflected by the optical-path deflection mirror 32. The change revolver 37 for the illumination-light study system aperture diaphragms for setting the size and the configuration of the effective light source as a request is arranged at the injection side of the 2nd fly eye lens 36. With this operation gestalt, in order to reduce the quantity of light loss by the illumination-light study system aperture diaphragm, magnitude of the flux of light to the 2nd fly eye lens 36 by the zoom lens 34 is made adjustable.
[0017] The flux of light injected from opening of an illumination-light study system aperture diaphragm illuminates the lighting field diaphragm (reticle blind) 41 through the condensing lens group 40. In addition, it is indicated about the lighting field diaphragm 41 by JP,4-196513,A and the U.S. Pat. No. 5,473,410 official report corresponding to this.
[0018] The light from the lighting field diaphragm 41 is drawn on Reticle R through the lighting field-

diaphragm image formation optical system (reticle blind image formation system) which consists of deflection mirrors 42 and 45 and lens groups 43, 44, and 46, and the lighting field which is the image of opening of the lighting field diaphragm 41 is formed on Reticle R. The light from the lighting field on Reticle R is led to up to Wafer W through a projection optical system PL, and the cutback image of the pattern in the lighting field of Reticle R is formed on Wafer W. The reticle stage RS holding Reticle R is movable two-dimensional in XY flat surface, the position coordinate is measured by the interferometer 50, and position control is carried out. Moreover, the wafer stage WS holding Wafer W is movable two-dimensional in XY flat surface, the position coordinate is measured by the interferometer 51, and position control is carried out. These enable it to carry out the synchronous scan of Reticle R and the wafer W at high degree of accuracy. In addition, the illumination-light study system 21 is constituted by a laser light source 20 - lighting field-diaphragm image formation optical system, etc. which were mentioned above.

[0019] Like F2 laser beam (wavelength: 157nm) used with this operation gestalt, when using light of a vacuum ultraviolet area as an exposure beam, as ****** material with good permeability (optical element), it is restricted to the quartz glass which doped fluorite (crystal of CaF2), a fluorine, hydrogen, etc., magnesium fluoride (MgF2), etc. In this case, in a projection optical system PL, since it is difficult, constituting only from a dioptrics member and acquiring desired image formation properties (chromatic-aberration property etc.) may adopt the reflective refractive media which combined the dioptrics member and the reflecting mirror.

[0020] Moreover, when using light of a vacuum ultraviolet area as an exposure beam, oxygen, water (steam), the matter (a carbon monoxide, carbon dioxide, etc.) of a hydrocarbon system, the organic substance, a halogenide, etc. need to eliminate the matter (it is hereafter called the "extinction matter" suitably) which has a strong absorption property to the light of the starting wavelength band from the optical path. Therefore, with this operation gestalt, an illumination-light way (optical path in which it results to a laser light source 20 - Reticle R), and a projection optical path (optical path in which it results to Reticle R - Wafer W) are intercepted from an external ambient atmosphere. The nitrogen as low absorptivity gas which has a property with little absorption for those optical paths to the light of a vacuum ultraviolet area, It is filling with gas, such as helium, an argon, neon, a krypton, a xenon, and a radon, or those mixed gas (it is hereafter called suitably "low absorptivity gas" or "purge gas").

[0021] Specifically the optical path from the laser light source 20 to the adjustable beam attenuator 31 is intercepted by casing 60 from an external ambient atmosphere, the optical path from the adjustable beam attenuator 31 to the lighting field diaphragm 41 is intercepted by casing 61 from an external ambient atmosphere, lighting field-diaphragm image formation optical system is intercepted by casing 62 from an external ambient atmosphere, and it fills up with the above-mentioned low absorptivity gas in those optical paths. In addition, casing 61 and casing 62 are connected by casing 63. Moreover, in the projection optical system PL itself, the lens-barrel 69 serves as casing, and the internal optical path is filled up with the above-mentioned low absorptivity gas.

[0022] Moreover, casing 64 is intercepting the space between casing 62 and the projection optical systems PL which dedicated lighting field-diaphragm image formation optical system from the external ambient atmosphere, and the reticle stage RS which holds Reticle R to the interior is contained. The door 70 for carrying in and taking out Reticle R is formed in this casing 64, and the inert-gas-replacement room 65 for preventing polluting the ambient atmosphere in casing 64 in Reticle R at the time of carrying in and taking out is established in the outside of this door 70. The door 71 is formed also in this inert-gas-replacement room 65, and delivery of the reticle between the reticle stockers 66 which are keeping two or more sorts of reticles is performed through a door 71.

[0023] Moreover, casing 67 is intercepting the space between a projection optical system PL and Wafer W from the external ambient atmosphere, and the surface plate 83 grade which is laying the autofocus sensor 81 of the oblique incidence format for detecting the wafer stage WS, and the surface location (focal location) and surface tilt angle of a Z direction of Wafer W which hold Wafer W through the wafer holder 80, the alignment sensor 82 of an off-axis method, and the wafer stage WS in the interior is contain. The door 72 for carrying in and taking out Wafer-W is formed in this casing 67, and the inert-

gas-replacement room 68 for preventing polluting the ambient atmosphere of the casing 67 interior is established in the outside of this door 72. The door 73 is formed in this inert-gas-replacement room 68, and carrying in of the wafer W inside equipment and taking out of the wafer W to the equipment exterior are performed through this door 73.
[0024] As each low absorptivity gas (purge gas) with which it fills up between optical-path absentminded, it is desirable to use nitrogen and helium. Nitrogen can act as extinction matter to light about 150nm or less, and wavelength can use helium as low absorptivity gas to light with a wavelength of about 100nm or less. Thermal conductivity is about 6 times the nitrogen, and since the amount of fluctuation of the refractive index to an allobar is about 1 of nitrogen/8, helium is especially excellent in high permeability, and the stability and cooling nature of an image formation property of optical system. In addition, about other optical paths (for example, illumination-light way to a laser light source 20 - Reticle R etc.), nitrogen may be used as low absorptivity gas, using helium as low absorptivity gas about the lens-barrel of a projection optical system PL.
[0025] Here, the feed valve 100,101,102,103 is formed in each of casing 61, 62, 64, and 67, and these feed valves 100-103 are connected to the feed-pipe way in the gas supply system mentioned later. Moreover, the exhaust valve 110,111,112,113 is formed in each of casing 61, 62, 64, and 67, and these exhaust valves 110-113 are connected to the exhaust pipe way in a gas supply system, respectively.
[0026] Similarly the exhaust valve 114,115 which reaches feed valve 104,105 is formed also in the inert-gas-replacement rooms 65 and 68, a feed valve 106 and an exhaust valve 116 are formed also in the lens-barrel 69 of a projection optical system PL, and these are connected to the feed-pipe way or exhaust pipe way in a gas supply system.
[0027] Moreover, at the inert-gas-replacement rooms 65 and 68, it is necessary to perform inert gas replacement in the cases at the time of reticle exchange or a wafer intersection etc. For example, in the case of reticle exchange, a door 71 is opened, reticle is carried in in the inert-gas-replacement room 65 from the reticle stocker 66, a door 71 is shut, the inside of the inert-gas-replacement room 65 is filled with low absorptivity gas to it, a door 70 is opened after that at it, and reticle is laid on a reticle stage RS. Moreover, in the case of wafer exchange, a door 73 is opened, a wafer is carried in in the inert-gas-replacement room 68, this door 73 is shut, and the inside of the inert-gas-replacement room 68 is filled with low absorptivity gas. Then, a door 72 is opened and a wafer is laid on the wafer holder 80. In addition, in reticle taking out and wafer taking out, it is the procedure of this reverse. Moreover, in the case of the inert gas replacement of the inert-gas-replacement rooms 65 and 68, after decompressing the ambient atmosphere of the inert-gas-replacement interior of a room, low absorptivity gas may be supplied from a feed valve.
[0028] Moreover, in casing 64 and 67, possibility that the gas which performed inert gas replacement by the inert-gas-replacement rooms 65 and 68 may mix, and extinction matter, such as most quantity of oxygen, is mixing into the gas of these inert-gas-replacement rooms 65 and 68 is high. Therefore, it is desirable to perform inert gas replacement to the same timing as the inert gas replacement of the inert-gas-replacement rooms 65 and 68. Moreover, at casing and an inert-gas-replacement room, it is desirable to be filled up with the low absorptivity gas of a pressure higher than the pressure of an external ambient atmosphere.
[0029] Drawing 2 shows an example of the configuration of the gas supply system 200 which supplies the low absorptivity gas mentioned above as purge gas to each space on the optical path of the exposure beam mentioned above. The gas supply system 200 Predetermined low absorptivity gas The temperature control unit 204 for controlling the temperature of the sources 201 of gas supply, such as a gas bomb to hold, the gas transfer unit 202 which supplies low absorptivity gas to each space on an optical path, the exhauster 203 which discharges the gas which contains low absorptivity gas from each space on an optical path, and low absorptivity gas, It has the control unit 206 grade which controls in generalization the concentration meters 205a-205e which measure the concentration of the extinction matter in each space on an optical path, and the above-mentioned equipment.
[0030] Drawing 2 shows typically two or more space 250-254 (purge space is called henceforth) of the lens-barrel 69 interior in a projection optical system PL among between the exposure beam mentioned

above optical-path being absentminded as a supply place of low absorptivity gas. On both sides of the optical members (lens element) 300-303, two or more of such purge space 250-254 adjoins each other mutually, and is arranged. In addition, in this example, gaseous helium shall be used from viewpoints, such as the stability of an image formation property, as purge gas supplied between optical-path absentminded. However, since it is expensive, when the wavelength of an exposure beam is 150nm or more like F2 laser, gaseous helium may use nitrogen gas as purge gas in order to reduce operation cost.
[0031] A gas transfer unit 202 supplies the gaseous helium to each purge space 250-254 through the feed-pipe way 210 by pressurizing the gaseous helium sent from the source 201 of gas supply, for example. In this example, the feed valves 106a-106e the flow of [feed valves] can be controlled every purge space 250-254 are formed, and the feed-pipe way 210 also has branching structure corresponding to this. While the gaseous helium sent from a gas transfer unit 202 is supplied to each purge space 250-254 through each feed valves 106a-106e, the flow rate is controlled separately every purge space 250-254.
[0032] Moreover, on the feed-pipe way 210 between a gas transfer unit 202 and feed valves 106a-106e, the filter 211 for removing the impurity contained in gaseous helium is arranged. In addition, instruments, such as a pressure gage for measuring the pressure in a path and a concentration meter for measuring the concentration of the extinction matter contained in gaseous helium, may be further formed on this feed-pipe way 210. Moreover, when the gas discharged from the source 201 of gas supply fully has the pressure, it is also possible to exclude a gas transfer unit 202.
[0033] chemical one, such as various polymers, such as metals, such as stainless steel washed as piping used for the feed-pipe way 210, or washed tetrafluoroethylene, tetrafluoroethylene-tele fluoro (alkyl vinyl ether), or a tetrafluoroethylene-hexafluoro propene copolymer, -- the thing of a clean raw material is used and metal, such as stainless steel by which **** processing was carried out, for example, or the thing of the various products made from a polymer is used as a piping joint.
[0034] What can remove the extinction matter which mentioned the filter 211 above according to operations, such as adsorption, absorption, or filtration, is used. Specifically, the filter for removing dust (particle) etc. is used for the Lords, such as a chemical filter from which absorptivity gas, such as oxygen, is removed or a HEPA filter, and a ULPA filter. Moreover, for example, a charcoal filter and a zeolite filter can be used as a filter for removing impurities, such as the organic substance of silicon systems, such as ammonia, a compound of an amine system, an ion system, a siloxane, a silazane, and a silanol, and a plasticizer, flame retarders (free-wheel-plate RUSAN ester etc.) (phosphoric acid, chlorine-based matter).
[0035] In addition, two or more filters 211 may be arranged side by side on the feed-pipe way 125. For example, the efficient activity of a filter is attained by arranging to a serial two or more filters with which properties differ, and arranging the thing of a high grade specification to the downstream more. Moreover, it becomes possible by arranging a filter to juxtaposition to suppress resistance of flow with a filter. Or it becomes possible to raise the workability of filter exchange by letting gas pass selectively to the filter arranged at juxtaposition.
[0036] An exhauster 203 generates vaccum pressure and discharges the gas in each purge space 250-254 through the exhaust pipe way 212. The gas discharged from each purge space 250-254 is discharged by the space of for example, the equipment exterior. In addition, the gas discharged from each purge space 250-254 may be refined, and may be reused as purge gas. By reuse of gas, the consumption of purge gas (this example gaseous helium) can be reduced.
[0037] A temperature control unit 204 controls the temperature of the gaseous helium supplied to the purge space 250-254 to a predetermined value. The temperature of gas is controlled by for example, room temperature (20-25 degrees C) extent. By controlling the temperature of gas uniformly, heat deformation of an optical member can be controlled in the purge space 250-254. In addition, the temperature of gas is not limited to what was mentioned above. Moreover, when using helium as purge gas like this example, in order to control the temperature change of helium, as for a temperature control unit, being arranged near each casing is desirable.
[0038] Densimeters 205a-205e are installed to each of each purge space 250-254 by this example. As a

concentration meter, a thing called the compound sensor which combined concentration meters, such as an oxygen analyzer, a dew-point instrument as a concentration meter of a steam, and a sensor of a carbon dioxide, or these sensors is adopted, for example. In addition, the sensor which measures indirectly the equipment of the kind of a mass spectrometer and the concentration of the extinction matter contained in gas by passing a current and measuring the current value as a concentration meter may be used.

[0039] In the above-mentioned gas supply system 200, the gaseous helium of a high grade is supplied to each purge space 250-254 through the above-mentioned filter 211. Thereby, the inside of the space 250-254 is filled with gaseous helium. At this time, based on the measurement result of Densimeters 205a-205e, the amount of supply of the gas to each space 250-254 is controlled by the gas supply system 200 through feed valves 106a-106e so that the concentration of the extinction matter in each purge space 250-254 turns into below predetermined threshold limit value (it is 10 ppm at a volume ratio). Thereby, the extinction matter in each purge space 250-254 is reduced.

[0040] Here, two or more purge space 250-254 in the projection optical system PL shown in drawing 2 includes at least two space (for example, purge space 251 and 253) which consists of mutually different configurations about the travelling direction (or the optical-axis AX direction) of the exposure beam IL. For example, the purge space 251 is formed in both the concave configuration of the lens element 301 of both the convex configuration as well as the lens element 300 of both the convex configuration about the travelling direction of the exposure beam IL (the so-called air lens of both the concave configuration). On the other hand, the purge space 253 is formed in both the convex configuration about the travelling direction of the exposure beam IL of the lens element 302 of both the concave configuration, and the lens element 303 of a meniscus configuration which turned the convex to Wafer W side (the so-called air lens of both the convex configuration).

[0041] If it controls by the gas supply system 200 below to the predetermined threshold limit value which mentioned above the concentration of the extinction matter of each purge space 250-254 Then, concentration control of the extinction matter is further performed among two or more purge space 250-254 to the purge space 251 of both the above-mentioned concave configuration, and the purge space 253 of both the convex configuration. The condition of having controlled to other purge space 250, 252, and 254 below to the predetermined threshold limit value which mentioned the concentration of the extinction matter above is maintained.

[0042] Concentration control to the purge space 251 of both the concave configuration and the purge space 253 of both the convex configuration is performed based on the measurement result of the quantity of light monitor 305 (refer to drawing 3) arranged at injection one end of a projection optical system PL. Moreover, in addition to the supply system of the gaseous helium mentioned above, the gas supply system 200 is equipped with the supply system of the oxygen gas which is the extinction matter for this concentration control.

[0043] Drawing 3 shows typically the example of a configuration of the supply system of oxygen gas. It sets to drawing 3 and the oxygen supply system 310 is equipped with the quantity of light monitor 305 and the control unit 206 grade mentioned above for measuring the intensity distribution of the oxygen supplies 311, such as a gas bomb with which it was compressed or liquefied and oxygen was held, the flow control valves 312 and 313 which control the amount of supply of oxygen, and the energy beam injected from the projection optical system PL. In addition, the feed-pipe way 315 for oxygen gas connected to the oxygen supply 311 is connected to the feed-pipe way 210 for gaseous helium through each flow control valves 312 and 313. Moreover, the quantity of light monitor 305 is arranged free [the insertion and detachment to injection one end of for example, the projection optical system PL].

[0044] The amount of supply of the oxygen gas to the purge space 251 and 253 is controlled by the above-mentioned oxygen supply system 310 through flow control valves 312 and 313 so that the intensity distribution of the exposure beam IL injected from the projection optical system PL are measured and nonuniformity on the strength is canceled based on the measurement result by the quantity of light monitor 305.

[0045] Here, in the purge space 253 of both the convex configuration, since the optical path of a

periphery is short compared with near optical-axis AX, when the extinction matter is contained in the purge space 253, more energy of the exposure beam IL which passes along near optical-axis AX compared with a periphery is absorbed. On the other hand, in the space 251 of both the concave configuration, since the optical path of a periphery is long compared with near optical-axis AX, when the extinction matter is contained in the purge space 251, more energy of the exposure beam IL which passes along a periphery compared with near optical-axis AX is absorbed.
[0046] That is, if oxygen is supplied to the purge space 253 of both the convex configuration and concentration of the extinction matter in the space 253 is made high, compared with a periphery, as for the reinforcement of the exposure beam IL, near optical-axis AX will become weak. On the contrary, if oxygen is supplied to the purge space 251 of both the concave configuration and concentration of the extinction matter in the space 251 is made high, compared with near optical-axis AX, as for the reinforcement of the exposure beam IL, a periphery will become weak.
[0047] Therefore, when near optical-axis AX (core) is strong compared with a periphery, and the intensity distribution of the exposure beam IL measured with the quantity of light monitor 305 supply oxygen gas to the purge space 253 of both the convex configuration and raise the concentration of the extinction matter of the space 253, the beam reinforcement near [strong] optical-axis AX becomes weak relatively, and nonuniformity on the strength is canceled. On the contrary, when a periphery is strong compared with near optical-axis AX (core), and the intensity distribution of the exposure beam IL measured with the quantity of light monitor 305 supply oxygen gas to the purge space 251 of both the concave configuration and raise the concentration of the extinction matter of the space 251, the beam reinforcement of the strong periphery becomes weak relatively, and nonuniformity on the strength is canceled.
[0048] Thus, the concentration of the extinction matter in the purge space 251 of both the concave configuration and the purge space 253 of both the convex configuration is separately controlled by the gas supply system 200 of this example according to the absorption property of energy based on the configuration of the space. Thereby, the nonuniformity of a energy beam on the strength is canceled, and equalization of the intensity distribution of the exposure beam IL in injection one end (on the Wth page of a wafer) of a projection optical system PL is attained.
[0049] Therefore, in the aligner 10 of this example shown in previous drawing 1 , by having the above-mentioned gas supply system 200, the homogeneity of the exposure beam IL irradiated by Wafer W on the strength can improve, and improvement in exposure precision can be aimed at.
[0050] As mentioned above, although the suitable example of an operation gestalt concerning this invention was explained referring to an accompanying drawing, it cannot be overemphasized that this invention is not limited to the starting example. If it is this contractor, it will be clear that it can hit on an idea for various kinds of examples of modification or examples of correction in the criteria of the technical thought indicated by the claim, and it will be understood as what naturally belongs to the technical range of this invention also about them.
[0051] For example, although oxygen gas is supplied to two space of a mutually different configuration and nonuniformity of an exposure beam on the strength is canceled in the above-mentioned example, not only two but one or three or more are sufficient as the space which supplies oxygen gas. Moreover, the configuration of the space which supplies oxygen gas is also limited to neither both the convex configuration nor both the concave configuration, but the configuration of arbitration is applied. That is, when the extinction matter is contained in the space, the absorption property of how an exposure beam is absorbed is searched for beforehand, and it can respond to the space of the configuration of arbitration by supplying oxygen gas to the space based on the absorption property.
[0052] Moreover, other extinction matter, such as not only oxygen but carbon dioxide gas, is sufficient as the gas supplied to space for the dissolution of nonuniformity on the strength.
[0053] Moreover, although the above-mentioned example explained typically the example which applied the projection optical system as optical equipment, the optical equipment of this invention is not limited to a projection optical system, and can apply an illumination-light study system etc. to other optical equipments.

[0054] Moreover, when many absorptivity gas, such as air, is contained in purge space, before supplying gaseous helium in supplying gaseous helium in purge space, it is good to once discharge the gas in the space with an exhauster. Thereby, the inside of the above-mentioned purge space 250-254 can be permuted more by the gaseous helium which is low absorptivity gas in a short time.
[0055] Moreover, although purge space shall have airtightness, not necessarily have airtightness and there may be. [no] For example, you may make it hold the atmospheric pressure in space in the condition of a request of the gas in space by making it keep it higher than an external atmospheric pressure. In addition, as a member pinched among two or more purge space, parallel plates, such as a mirror besides the lens element mentioned above, are also contained. Especially, in short wave Nagamitsu like vacuum-ultraviolet light, catoptric system may be adopted and this invention is preferably used also for such a case.
[0056] Moreover, in order to eliminate the extinction matter from on an optical path, it is desirable to take the measures which reduce the amount of degasifying from a structural material front face beforehand. (2) structural-material front face which makes surface area of (1) structural material small For example, mechanical polishing, It grinds by electrolytic polishing, BAL polish, chemical polishing, or the approach of GBB (Glass Beads Blasting). By technique, such as blasting of fluids, such as (3) ultrasonic cleaning, a clean dried air, etc. which reduce the surface roughness of a structural material, and vacuum heating degasifying (baking) There is the approach of ** of installing neither the electric-wire coat matter containing (4) hydrocarbons or a halogenide which washes a structural material front face, nor a seal member, adhesives (O ring etc.), etc. in optical-path space as much as possible.
[0057] Moreover, a vacuum pump, a cryopump, etc. are used as an exhauster made to generate vaccum pressure. A cryopump is a kind of a vacuum pump, is the thing of the format which cools SOBENTO, such as activated carbon and a synthetic fluoride stone, with refrigerants, such as nitrogen, it places the field (cryopanel) cooled by very low temperature (10-15K) in the vacuum, adsorbs gases, such as H2, helium, and gases other than Ne (for example, N2, Ar, etc.), in respect of this, and makes a high vacuum.
[0058] Moreover, as for the case (a tube-like object etc. is good) which constitutes covering of a wafer control unit from an illumination system chamber, and piping which supplies penetrable gas, it is desirable to form by various polymers, such as ingredient with little impurity gas (degasifying), for example, stainless steel, tetrafluoroethylene, and tetrafluoroethylene-TERUFURUORO (alkyl vinyl ether) or a tetrafluoroethylene-hexafluoro propene copolymer.
[0059] Moreover, as for the cable which supplies power to the drives in each case (a reticle blind, stage, etc.) etc., it is desirable to carry out clothing with an ingredient with little impurity gas (degasifying) similarly mentioned above.
[0060] Moreover, as for this, as for degasifying from the sensitization material (photoresist) applied on the wafer, an amount and a class change with classes, temperature, etc. of sensitization material including the extinction matter. Therefore, it is good to investigate the amount of degasifying from sensitization material, and the class beforehand, and for sensitization material to adjust the amount of supply of low absorptivity gas. While this eliminates the extinction matter certainly from the working distance section, it becomes possible to hold down the consumption of expensive low absorptivity gas to necessary minimum generally.
[0061] Moreover, it is clear that this invention's it is applicable to the projection aligner of not only the projection aligner of a scan exposure mold but an one-shot exposure mold (stepper mold) etc. The projection optical systems with which these are equipped may be not only reflective refractive media but refractive media, and a reflective system. Furthermore, the scale factors of a projection optical system may be not only a cutback scale factor but actual size, and amplification.
[0062] Moreover, wavelength, such as higher harmonics, such as a case where ArF excimer laser light (wavelength of 193nm) is used, and Kr2 laser beam (wavelength of 146nm), Ar2 laser beam (wavelength of 126nm), an YAG laser, or a higher harmonic of semiconductor laser, can apply this invention also to the vacuum-ultraviolet light which is 200nm - about 100nm as an energy beam.
[0063] Moreover, single wavelength laser of the infrared region oscillated instead of from DFB

(Distributed feedback: distribution feedback type) semiconductor laser or a fiber laser or a visible range, such as excimer laser and F2 laser, may be amplified with the fiber amplifier with which the erbium (Er) (or both an erbium and an ytterbium (Yb)) was doped, and the higher harmonic which carried out wavelength conversion may be used for ultraviolet radiation using a nonlinear optical crystal.
[0064] Moreover, it can carry out suitable also to the aligner for the liquid crystal which exposes a liquid crystal display component pattern on the glass plate of a square shape, and the aligner for manufacturing the thin film magnetic head widely, for example, without being limited to the aligner for semi-conductor manufacture as an application of an aligner.
[0065] Moreover, when using a linear motor for a wafer stage or a reticle stage, whichever of the magnetic levitation mold using the air floatation mold and the Lorentz force, or the reactance force which the air bearing was used may be used. Moreover, the type which moves along with a guide is sufficient as a stage, and the guide loess type which does not prepare a guide is sufficient as it.
[0066] Moreover, what is necessary is to connect a magnet unit (permanent magnet) or an armature unit to a stage, and just to establish another side of a magnet unit and an armature unit in the migration side side (base) of a stage, when using a flat-surface motor as a driving gear of a stage.
[0067] Moreover, the reaction force generated by migration of a wafer stage may be mechanically missed to the floor (earth) using a frame member as indicated by JP,8-166475,A. This invention is applicable also in the aligner equipped with such structure.
[0068] Moreover, the reaction force generated by migration of a reticle stage may be mechanically missed to the floor (earth) using a frame member as indicated by JP,8-330224,A. This invention is applicable also in the aligner equipped with such structure.
[0069] as mentioned above, the aligner of this application operation gestalt -- this application -- it is manufactured by assembling the various subsystems containing each component mentioned to the claim so that a predetermined mechanical precision, electric precision, and optical precision may be maintained. In order to secure these various precision, before and after this assembly, adjustment for attaining electric precision is performed about the adjustment for attaining mechanical precision about the adjustment for attaining optical precision about various optical system, and various mechanical systems, and various electric systems. Like the assembler from various subsystems to an aligner, the mechanical connections between [various] subsystems, wiring connection of an electrical circuit, piping connection of an atmospheric-pressure circuit, etc. are included. It cannot be overemphasized that it is in the front like the assembler from these various subsystems to an aligner like the assembler of each subsystem each. If it ends like the assembler to the aligner of various subsystems, comprehensive adjustment will be performed and the various precision as the whole aligner will be secured. In addition, as for manufacture of an aligner, it is desirable to carry out in the clean room where temperature, an air cleanliness class, etc. were managed.
[0070] And when the wafer with which exposure was performed as mentioned above passes through a development process, a pattern formation process, a bonding process, packaging, etc., electron devices, such as a semiconductor device, are manufactured.
[0071]
[Effect of the Invention] According to the optical equipment of this invention, the intensity distribution of the energy beam in a injection edge can be made into homogeneity by controlling the concentration of the extinction matter in two or more space on the optical path of a energy beam separately according to the configuration of each space.
[0072] Moreover, since equalization of the intensity distribution of the energy beam irradiated by the substrate is attained according to the aligner of this invention, exposure precision can be raised.

[Translation done.]